

MINERALOGY AND NOBLE GAS SIGNETURES OF DESERT METEORITE SHİŞR 007 UREILITE.

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Carbonaceous materials are key objects to elucidate origin and formation of ureilites. We have characterized a large (1.0 × 1.5mm) carbonaceous material in Shişr 007 ureilite by multidiscipline techniques for mineralogy and noble gas signatures. In addition, chemical compositions and shock stages of host silicates were also determined.

Core compositions of olivine (Fo=79) and pyroxene (En=73) are close to the average composition of silicates in ureilites [1]. Olivine shows undulatory extinction and planar deformation fractures, corresponding to shock stage S3 [2]. Narrow (10-100µm) reduction rims occur around olivine and pyroxene grains and contain tiny Fe metal inclusions. Compositions of olivine and pyroxene in reduction rims are enriched in Mg compared with the cores. These rims have been produced by reduction of FeO by carbon at grain boundaries during brief, shock heating at elevated temperature. There are many fragments of relict graphite in Fe-Ni-S melt in contact with the reduction rims. The presence of the Fe-Ni-S melt and the escape of melting of olivine and pyroxene suggest that temperatures were between 1200 and 1600°C at the time of the rim formation.

The large carbonaceous material is composed of fine diamonds and graphites. It has rectangular, blade-like shape, implying that it was a large single crystal of graphite, as is observed in ALH 78019 [3]. Raman spectroscopy revealed the presence of compressed graphite that is an intermediate phase formed during graphite-diamond phase transition. Using an edged tool, the large carbonaceous material was separated into small pieces typically 200-300µm in diameter. Individual pieces were first measured by synchrotron X-ray diffraction and the results indicated that diamond-graphite ratio varies among pieces. Then each piece was analyzed by the stepwise heating method to obtain noble gas compositions using "Pot-pie furnace" designed for µg sample analysis. A major part (80~95%) of primordial ³⁶Ar, ⁸⁴Kr, and ¹³²Xe was released at 1900-2100°C fraction, indicating that a main carrier phase of noble gases is diamond. The release temperature is consistent with that achieved during the rim formation. Elemental ratios of ³⁶Ar/¹³²Xe and ⁸⁴Kr/¹³²Xe are 200-450 and 1.0-1.8, respectively, in the range of diamond-rich carbonaceous materials in other ureilites [e.g., 4]. Concentrations of primordial noble gases vary and do not correlate with elemental ratios and the diamond-graphite ratios. Our analyses suggest that Shişr 007 ureilite contains diamond with variable noble gas concentration and ³⁶Ar/¹³²Xe and ⁸⁴Kr/¹³²Xe elemental ratios.

References: [1] Mittlefehldt D. W. et al. 1998. Ureilites. In *Planetary Materials* (ed. J. J. Papike): Chapter 4. 73-95 [2] Stöffler D. et al. 1991. *Geochimica et Cosmochimica Acta* 55: 3845-3867. [3] Goodrich C. A. et al. 2000. *Meteoritics & Planetary Science* 27: 327-352. [4] Göbel R. et al. 1997. *Journal of Geophysical Research* 83: 855-867.